Answer on Question #60560-Engineering-Mechanical Engineering

A heat exchanger produces dry steam at 100 C from feed water at 30C at a rate of 1.5 kgs^-1. The heat exchanger receives heat energy at a rate of 600 kW from the fuel used. The specific heat capacity of water is 4187 Jkg^-1K^-1 and its specific latent heat of vaporisation is 2257 Jkg^-1.

i) Determine the heat energy received per kilogram of steam produced.

Solution

$$\frac{dm}{dt} = 1.5\frac{kg}{s}$$

$$T_c = 30C$$

$$T_h = 100C$$

$$P = 600kW$$

$$C = 4187\frac{J}{kgK}$$

$$L = 2257\frac{J}{kg}$$

i)

$$Q = mC(T_h - T_c) + mL$$

$$dQ = C(T_h - T_c)dm + Ldm$$

$$\frac{dQ}{dm} = C(T_h - T_c) + L = 4187\frac{J}{kgK}(100C - 30C) + 2257\frac{J}{kg} = 295347\frac{J}{kg}$$